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Phyllostomid Bats of Colombia: Annotated Checklist, Distribution, and Biogeography

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Abstract

We report 118 confirmed phyllostomid species for Colombia, and 14 species potentially present in the country, for a total of 132 species representing 40 genera and10 subfamilies. All known phyllostomid subfamilies are represented in Colombia, with the exception of the subfamily Macrotinae (not present in South America). At 118 known species, Colombia has the greatest number of phyllostomid bats of any country. Included in the lists are 27 recently recognized species (19 newly described species and eight newly elevated species), 19 of which are confirmed for Colombia, while eight are potentially present. The checklist is accompanied by 18 taxonomic comments explaining recent changes in the taxonomy of the group. In addition, Geographic Information Systems (GIS)-based models of potential distribution were created for both confirmed and potentially present phyllostomid species, and species richness patterns were analyzed. Finally, comments on the biogeography of the group are included.

Key words: bats, biogeography, checklist, Chiropterans, Colombia, distribution models, Phyllostomidae, taxonomy

Resumen

Reportamos 118 especies de murciélagos filostómidos para Colombia y 14 especies potencialmente presentes en el país, para un total de 132 especies que representan 40 géneros y 10 subfamilias. Todas las subfamilias de murciélagos filóstomidos están presentes en Colombia con excepción de de la subfamilia Macrotinae (ausente en Sur América). Con 118 especies reconocidas, Colombia es el país que poseé el mayor número de murciélagos filostómidos. Nuestro listado incluye 27 especies reconocidas recientemente (19 recientemente descritas y ocho recientemente elevadas), 19 de las cuales están confirmadas para Colombia mientras ocho corresponden a especies potencialmente presentes en el país. Nuestra lista está acompañada por 18 comentarios que explican los cambios recientes en la taxonomía del grupo. Adicionalmente, modelos de distribución potencial basados en Sistemas de Información Geográfica (SIG) fueron generados tanto para las especies de murciélagos filostómidos presentes como potenciales en el país, al tiempo que sus patrones de diversidad fueron analizados para los murciélagos filostómidos de Colombia. Finalmente los patrones generales de la biogeografía del grupo son comentados.

Palabras clave: biogeografía, Colombia, lista anotada, modelos de distribución, murciélagos, Phyllostomidae, Quirópteros, taxonomía

Introduction

In recent years, the availability of genetic data for determining phylogenetic relationships, as well as the description of new species and elevation of subspecies to species status, has resulted in substantial revisions at many taxonomic levels of Neotropical mammals. Phyllostomid bats are one of the most intensively studied groups of Neotropical mammals and a major source of new species descriptions and higher taxonomic changes to accommodate monophyly. Herein, previous works, such as *Mamíferos (Synapsida: Theria) de Colombia* (Alberico et al. 2000), *Mammal Species of the World* (Wilson and Reeder 2005), *Mammals of South America* (Gardner 2008), and the *Global Mammal Assessment* (IUCN 2008), were used to generate a checklist of phyllostomid bats from Colombia. This checklist includes recently described taxa and newly elevated species, as well as those species that might be expected to occur in Colombia. The systematic classification of Baker et al. (2003) is followed. This systematic arrangement is based on statistically supported monophyly which was not achieved in previous classifications of this complex of bats (Baker et al. 1989; Koopman 1993; Wetterer et al. 2000). To facilitate comparison of our checklist to that of Alberico et al. (2000) (the most comprehensive checklist of Colombian mammals available to date), we follow their format. Differences between Alberico et al. (2000) and the current checklist are highlighted within the list by symbols, which are explained in more detail in the text. The checklist also includes references. Models of potential distribution for each Colombian phyllostomid species also are provided; these maps were generated based on marginal localities derived from collecting localities of museum voucher specimens from major mammal collections in Colombia and the United States. The distribution maps were then used to investigate affinities in species composition among Colombian ecoregions as outlined by Hernández-Camacho et al. (1992). In addition, distribution models were used to determine phyllostomid richness distribution in Colombia and the relationship between environmental variables and patterns of species richness. Finally, we discuss the origin of the geographic partitioning observed among Colombian phyllostomid bats.

Methods

Data gathering.—An intensive search for Colombian phyllostomid bat records was conducted using three primary sources: digital museum databases, records reported in the scientific literature, and direct inspection of museum voucher specimens in Colombian and American institutions. This search resulted in 19,952 records obtained from museum databases and literature records, as follows: American Museum of Natural History (AMNH) (N = 950); British Museum of Natural History (BM) (three Colombian records reported in the literature); Instituto Alexander von Humboldt (IAvH) (N = 91); Instituto de Ciencias Naturales, Universidad Nacional de Colombia (ICN) (N = 9,477); Field Museum of Natural History (FMNH) (N = 1,556); Museo de Historia Natural Universidad del Cauca (MNHUC) (N = 543); Museo de Historia Natural Universidad de los Andes (MNHU) (six selected records reported in the literature); Museo de Historia Natural Universidad Distrital de Bogotá "Francisco José de Caldas" (MUD) (N = 330); Museo de Historia Natural de la Universidad Tecnológica del Chocó (MZCH) (N = 600); National Museum Smithsonian Institution (USNM) (N = 5,980); Royal Ontario Museum (ROM) (52); Texas Tech University Museum (TTU) (N = 259); Universidad del Valle (UV) (N = 105). In addition, a selected subset of phyllostomid records was taxonomically examined by direct inspection of museum voucher specimens as follows: ICN (N = 788); FMNH (N = 220); TTU (N = 75); USNM (N = 193). The complete list of specimens is in the supplementary material section available online at the webpage of the Natural Science Research Laboratory, Museum of Texas Tech University (www.nsrl.ttu.edu).

Distribution models.—Models of potential distribution were created for each phyllostomid bat species present in Colombia. These models were generated using as data points the marginal localities in Gardner (2008) as well as 17,778 records of Colombian phyllostomid species we were able to georeference based on electronic gazetteers available from Falling Rain Genomics, Inc. (www.fallingrain.com) and the National Geospatial Intelligence Agency (http://geonames.nga.mil/ggmaviewer/MainFrameSet.asp).

Georeferenced Colombian phyllostomid sampling localities were converted into point polygon layers in ArcGIS 9.3. Each layer representing species distributional points was then placed over a polygon layer of Neotropical ecoregions obtained from the website of the World Wildlife Fund (http//:www.wwf.org). Ecoregions intercepting species distributional records were selected using the *Select by location* option of ArcGIS 9.3 and exported as vector files. The exported files representing selected ecoregions were set as masks in the Spatial Analyst extension of ArcGIS 9.3. Raster layers representing minimum and maximum species elevational limits were then created for each species based on elevational ranges reported in the literature. Digital information on elevation for the Neotropics was derived from a Digital Elevation Model (DEM) available at the website WorldClim (http://www.worldclim.org/bioclim.htm) (script incorporated into the Spatial Analyst extension of ArcGIS 9.3: [sp_name_elevational_range] = ([DEM] >= minimum elevational value AND [DEM] <= maximum elevational value). Obtained raster files were double-delimited by ecoregion and elevational ranges. Final models were classified with cell values of one (1) for species presence and zero (0) for species absence. Cell size of raster files was adjusted to represent 1 km^2.

Patterns of species richness.—A model of phyllostomid species richness in Colombia was obtained by combining all raster files representing individual species distribution models in the Spatial Analyst extension of ArcGIS 9.3.

Correlation between richness and environmental variables.—A raster layer representing the Colombian territory was created with a cell size of 0.05 dpi and each cell was converted into points by applying the *Conversion tool* in the Spatial Analyst extension of ArcGIS 9.3; this resulted in a point layer of 14,560 points. This point grid was placed on a raster layer representing phyllostomid species richness; richness values were then extracted as a point layer in ArcGIS 9.3 using the *Extract values to point* tool in the Spatial Analyst extension of ArcGIS 9.3. The same procedure was applied to raster layers representing elevation, minimum temperature of the coldest month of the year, and precipitation (climate data from www.diva-gis.org/climate.htm). Databases associated with the point layers extracted from each environmental variable, as well as the database associated with the richness point layer, were combined into a single database and exported to the statistical package PAST (version 1.90, available at http://folk.uio.no/ohammer/past), and a Spearman correlation was performed among richness and environmental variables.

Composition affinity among Colombian natural regions.—A presence-absence matrix was created based on presence of confirmed Colombian phyllostomid species by natural region(s). A hierarchical cluster analysis was then performed using the statistical software PAST (version 1.90). We chose this type of analysis due to its natural interpretation in terms of graph-based clustering.

RESULTS AND DISCUSSION

Simmons (2005) and Gardner (2008) were used as the basic data from which all more recent conclusions and suggested taxonomic changes were evaluated and incorporated (Table 1). A major departure from Simmons (2005) and Gardner (2008) was the higher taxonomic structure in which genera and species are ordered. This classification divides the family Phyllostomidae into 11 subfamilies (Macrotinae, Micronycterinae, Desmodontinae, Lonchorhininae, Phyllostominae, Glossophaginae, Lonchophyllinae, Carollinae, Glyphonycterinae, Rhinophyllinae, Stenodermatinae) documented by multiple gene DNA sequence data to be monophyletic clades. This classification differs substantially from the previously proposed subfamilies in Koopman (1993), Simmons (2005), and Gardner (2008). The changes are analogous to those for families of bats of Teeling et al. (2005) and for vespertillionid bats proposed by Hoofer and Van Den Busche (2003).

Table 1. List of phyllostomid bats from Colombia. Symbols are as follows: additions and changes to Alberico et al. (2000) (+); endemic (•); taxonomic comments and consideration (§). Elevational ranges in meters. Abbreviations of Colombian natural regions: Amazon (amz); Andean (and); Caribbean (car); Orinoquia (ori); and Pacific (pac). Abbreviations of Colombian departments: Amazonas (ama); Antioquia (ant); Arauca (ara); Atlántico (atl); Bolivar (bl) (2); Boyacá (by); Caldas (cl); Caquetá (caq); Casanare (cas); Cauca (cau); Cesar (ce); Chocó (cho); Córdoba (co); Cundinamarca (cun); Guainía (gn); Guaviare (gv); Huila (hu); La Guajira (gua); Magdalena (ma); Meta (met); Nariño (na); Norte de Santander (nsn); Putumayo (pu); Quindío (qui); Risaralda (ri); San Andrés (sand); Santander (snt); Sucre (su); Tolima (to); Valle del Cauca (vc); Vaupés (va); Vichada (vi). References of the scientific literature used as sources for records of Colombian phyllostomid bats are included in Appendix III.

Taxa	Region	Departments (records from reviewed literature)	Departments (records from museums)	Elevational range	Reference	Collections
PHYLLOSTOMIDAE						
Subfamily Micronycterinae						
Lampronycteris Sanborn 1949						
Lampronycteris brachyotis Dobson 1879	amz and car	ant gua va	bl to	0-700	Marinkelle & Cadena 1972	IAvH ICN 16955 MHNU USNM
Micronycteris Gray 1866						
Micronycteris hirsuta (Peters 1869)	amz and car pac	caq cau cl cho ma vc		20-1100	Sanborn 1932	AMNH ICN 17236 MHNUC UV
Micronycteris megalotis (Gray 1842)	co	ant caq cau cun cl cho ri vc	bo cas ce co hu gua ma me qui sand snt vi	25-2400	Dobson 1878	AMNH FMNH IAvH ICN 1597 MHNUC USNH UV
Micronycteris microtis Miller, 1898	amz and car ori	ant caq cun		15-2100	Simmons 1996	AMNH 99344
Micronycteris minuta (Gervais 1856)	co	ant cl cho met ma na vc	ama caq cas co cun gua nsn pu snt	5-1130	Koopman 1982	AMNH FMNH IAvH ICN MZCH TTU USNM UV
Micronycteris schmidtorum (Sanborn 1935)	amz and car pac	ant cho snt	gua ma	10-160	Koopman 1982	MZCH ICN 14751
Subfamily Desmodontinae						
Tribe Desmodontini						
Desmodus Wied-Neuwied 1826						
Desmodus rotundus (E. Geoffroyi St. Hilaire 1810)	co	ant caq cau cl cho cun gn na ri snt to vc	ama bl bo cas ce hu gua ma me na qui vi	0-2600	J.A. Allen 1900	AMNH FMNH IAvH ICN 466 MHNUC MUD MZCH ROM TTU USNM UV
Diaemus Miller 1906						
Diaemus youngi (Jentick 1893)	co	ant caq cau cho pu vc	cas hu me	0-500	de la Torre 1956	IAvH ICN 7580 UV
Tribe Diphyllini						
Diphylla Spix 1823						
Diphylla ecaudata Spix 1823	co	ant caq cau ma	gv me va	0-500	J.A. Allen 1900	AMNH FMNH IAvH ICN 14568 MHNUC USNM
Subfamily Lonchorhininae						
Lonchorhina Tomes 1863						
Lonchorrhina aurita Tomes 1863	co	ant caq cau cho met na vc	cl co nst ri	25-1550	Nicéforo María in Sanborn 1949	AMNH FMNH IAvH ICN 14716 MHNUC MZCH USNM UV
Lonchorrhina marinkellei Hernández-Camacho and Cadena 1978	amz	caq va		0-500	Hernández Camacho & Cadena 1978	ICN (holotype)
Lonchorrhina orinocensis Linares and Ojasti 1971	amz ori	caq met	ama va vi	75-620	Linares & Ojasti 1971	IAvH ICN 14671

Table 1. (cont.)

Taxa	Region	Departments (records from reviewed literature)	Departments (records from museums)	Elevational range	Reference	Collections
Subfamily Phyllostominae						
Tribe Macrophyllini						
Macrophyllum Gray 1838						
Macrophyllum macrophyllum (Schinz 1821)	co	ant cho ma vc	bl gua snt to va	10-1070	J.A. Allen 1900	IAvH ICN 18773 MUD UV
Trachops Gray 1847						
Trachops cirrhosus (Spix 1823)	co	ant caq cau ma vc	ama ara bl bo ce gua met pu nsn snt to va vi	10-1120	Dobson 1878	AMNH FMNH IAvH ICN 544 MHNUC MZCH TTU USNM UV
Tribe Phyllostomini						
Lophostoma d'Orbygni 1836 + § (1)						
Lophostoma brasiliense Peters 1866 +	amz car ori pac	ant cho gn met vc	caq cun hu gua met pu va	10-1100	Lemke et al. 1982	FMNH ICN 17932 USNM UV
Lophostoma carrikeri (J. A. Allen 1910) +	amz ori	caq met		45-700	McCarty et al. 1983	ICN 5140 FMNH
Lophostoma silvicolum d'Orbygni 1836 +	co	ant caq cau cl cho gn ma vc	gua me pu to va	10-850	J.A. Allen 1900	AMNH IAvH ICN 17877 MZCH USNM UV
Mimon Gray 1847						
Mimon bennettii (Gray 1838) § (2)	amz ori	cq gn me		0-500	Montenegro and Romero-Ruiz 2000	FMNH 113425 ICN USNM
Mimon cozumelae Goldman 1914 § (2) +	car pac	ant cho	co	0-500	Marinkelle & Cadena 1972	FMNH 69427 USNM 43175
Mimon crenulatum (E. Geoffroyi St. Hilaire 1803)	co	ant caq cau cl cho vc	co gn gua ma me va vi	5-830	Handley 1960	IAvH ICN 10231 MHNUC MZCH TTU UV
Phylloderma Peters 1865						
Phylloderma stenops Peters 1865	co	ama ant caq cho gn met vc	gn pu	0-1100	Marinkelle & Cadena 1972	IAvH ICN 4465 TTU UV
Phyllostomus Lacépède 1799						
Phyllostomus discolor (Wagner 1843)	co	ant caq cau cl cho cun gn met ri to vc	bl bo cas hu ma nsn su	10-1650	Valdivieso and Tamsitt	AMNH FMNH IAvH ICN 458 MZCH USNH UV
Phyllostomus elogatus (E. Geoffroyi St. Hilaire 1810)	amz	caq cau gn pu	cas co met va	10-850	Furman 1966	FMNH IAvH ICN 8320 MUD TTU USNM
Phyllostomus hastatus (Pallas 1767)	co	ant bo caq cau cl cho cun gn na to vc	ama bl cas ce hu gua met snt su vi	0-1295	J.A. Allen 1900	AMNH FMNH IAvH ICN 639 MHNUC MUD MZCH ROM TTU USNM UV
Phyllostomus latifolius (Thomas 1901)	amz pac	caq cau	va vc	0-500	Marinkelle & Cadena 1972	ICN 14603 MHNUC MNHU MZCH UV
Tonatia Gray 1827						
Tonatia saurophila Koopman and Williams 1951	amz and ori pac	ant caq cau met	hu ga pu va	10-140	Sanchez-Palomino et. al 1993	FMNH ICN 10254 UV
Tribe Vampirini						
Chrotopterus Peters 1865						
Chrotopterus auritus (Peters 1865)	co	ant caq cau cho me	ma gn gua	0-850	J.A. Allen 1900	AMNH IAvH ICN 14566
Vampyrum Refinesque 1815						
Vampyrum spectrum (Linnaeus 1758)	co	ant caq cau cl cho na vc	ama cu met vi	10-1065	Hall & Kelson 1959	IAvH ICN 176 USNM

Table 1. (cont.)

Taxa	Region	Departments (records from reviewed literature)	Departments (records from museums)	Elevational range	Reference	Collections
Subfamily Glossophaginae						
Tribe Choeronycterini						
Anoura Gray 1838						
Anoura aequatoris (Lönnberg 1921) +	and	ant cau cl na ri	hu to vc	1000-3000	Mantilla-Meluk and Baker 2006	FMNH ICN 7615 MHNUC
Anoura cadenai Mantilla-Meluk and Baker 2006 •	and pac	cau vc		1000-1500	Mantilla-Meluk and Baker 2006	ICN holotype NMNH
Anoura caudifer (E. Geoffroyi St. Hilaire 1818)	amz and car ori	ant cau caq ce cl cho ma na ri snt to va vc	cas cun hu gua met pu to va vi	500-2800	Mantilla-Meluk and Baker 2006	AMNH FMNH IAvH ICN 13833 MHNUC MUD ROM TTU USNM UV
Anoura cultrata Handley 1960	and car pac	ant caq cau cl cho nsn snt vc	cun met na nsn	0-1800	Lemke and Tamsitt 1979	FMNH IAvH ICN 7616 MHNUC UV
Anoura fistulata Muchhala, Mena, and Albuja 2005 +	and	na cau ri		1000-1800	Mantilla-Meluk and Baker 2008	FMNH 113512 ICN
Anoura geoffroyi Gray 1838	co	ant caq cau cl cho cun ri snt vc	cun gn met na to va	500-3600	J.A. Allen 1916	AMNH FMNH IAvH ICN 843 MHNUC MUD ROM USNM UV
Anoura latidens Handley 1984	and	cau		1000-1500	Handley 1984	MHNUC 1552
Anoura luismanueli Molinari 1994 +	and	cun snt		1000-1500	Mantilla-Meluk and Baker 2006	ICN 6602 MUD
Choeroniscus Thomas 1928						
Choeroniscus godmani (Thomas 1903)	and car	ant cau cl na met vc	cun	0-1600	Tamsitt et al. 1965	ICN 8064 MHNUC UV
Choeroniscus minor (Peters 1868) § (3)	amz and	cau caq cho cun gn to	pu va	0-1032	Valdivieso 1964	ICN 9775 MHNUC TTU UV
Choeroniscus periosus Handley 1966	pac	cau cho vc	na	0-500	Handley 1966	AMNH ICN MZCH NMNS (holotype)UV
Lichonycteris Thomas 1895						
Lichonycteris degener Miller 1931 +	amz	caq	gv	0-500	Montenegro and Romero-Ruiz 2000	ICN 14571
Lichonycteris obscura Thomas 1895 § (4)	amz pac	ant caq cl cho vc	co ma na to	0-500	Marinkelle & Cadena 1972	FMNH IAvH ICN MZCH USNM UV
Scleronycteris Thomas 1912						
Scleronycteris ega Thomas 1912 § (5)	amz	va		0-500	Alberico et al. 2000	IAvH ?
Tribe Glossophagini						
Glossophaga E. Geoffroyi St. Hilaire 1818						
Glossophaga commissarisi Gardner 1962	amz and	ama ant cho	bl caq ce gn ma met su vi	0-1000	Webster and Jones 1987	IAvH ICN MUD MZCH TTU 9093 UV
Glossophaga longirostris Miller 1898	and car	ant cl cun ma	atl bl bo ce gua su vi	5-1050	Miller 1898	AMNH FMNH IAvH ICN 5361 MUD USNM UV
Glossophaga soricina (Pallas 1766)	co	ant cau caq cl cho ma met gn to vc	ara caq cas cun gn vi	0-1560	J.A. Allen 1900	AMNH FMNH IAvH ICN 1749 MHNUC MZCH ROM TTU UV
Leptonycteris Lydekker 1891						
Leptonycteris curasoae Miller 1900	and car	bl snt	bo gua ma	0-900	Marinkelle and Grose 1966	FMNH MHNU ICN 2521 USNM

Table 1. (cont.)

Taxa	Region	Departments (records from reviewed literature)	Departments (records from museums)	Elevational range	Reference	Collections
Subfamily Lonchophyllinae						
Lionycteris Thomas 1913						
Lionycteris spurrelli Thomas 1913	amz and car pac	ant caq cau cho cun na me vc gn	cas gn va	90-1400	Thomas 1913	BM holotype IAvH ICN MZCH USNM UV
Lonchophylla Thomas 1903						
Lonchophylla cadenai Woodman and Timm 2006 + •	and pac	ri vc		0-1500	Woodman and Timm 2006	ICN USNM holotype
Lonchophylla chocoana Dávalos 2004 +	pac	vc		500-1000	Dávalos 2004	ICN ROM holotype MZCH USNM
Lonchophylla concava Goldman 1914 + § (6)	and car pac	cau cho na qui snt vc		0-1000	Albuja and Gardner 2005	FMNH ICN 7009 MHNUC USNM
Lonchophylla fornicata (Woodman 2007)	pac	cau		500 - 1560	Woodman 2007	ICN 13647 MHNUC
Lonchophylla handleyi Hill 1980 + § (7)	and	ant cau cho hu nar vc		500-1000	Alberico and Orejuela 1983	MHNUC 718 UV
Lonchophylla orienticollina Dávalos and Cohortals 2009 + • § (8)	and ori	met		0-1500	Dávalos & Corthals 2009	ICN holotype
Lonchophylla robusta Miller 1912	and car pac	ant cl cho cun na snt vc	bo ce gua ma nsn to	0-1900	Sanborn 1949	AMNH FMNH IAvH ICN 4397 MHNUC MZCH USNM UV
Lonchophylla thomasi J. A. Allen 1904	co	ant caq vc	ama bo gua met pu ri va vi	0-1000	Koopman 1982	FMNH IAvH ICN 9479 MZCH TTU USNM UV
Subfamily Carollinae						
Carollia Gray 1838 § (9)						
Carollia brevicauda (Schinz 1821)	co	ant cau caq cl cho gn met na ri snt to vc	ama ara bo cas ce cun gn gua hu ma me nsn qui to va vi	500-2000	Bangs 1900	AMNH FMNH IAvH ICN 5228 MHNUC MUD MZCH ROM TTU USNM UV
Carollia castanea H. Allen 1890	co	ant caq cau cl cho gn nsn ri vc	ama bo cas co cu ma me pu snt to	0-1500	Hershkovitz 1949	AMNH FMNH IAvH ICN 7049 MHNUC MUD MZCH TTU USNM UV
Carollia monohernandezi Cuartas and González 2004 + •	and car pac	ant bl caq cho		30-2660	Muñoz, Cuartas and González 2004	MUA holotype MZCH
Carollia perspicillata (Linnaeus 1758)	co	ant caq cau cl cho cun gn ma met ri snt to vc	ama ara atl bl bo cas ce co gn gua gv na nsn pu su va vi	0-2000	Dobson 1878	AMNH FMNH IAvH ICN 555 MUD MZCH ROM TTU USNMH UV
Subfamily Rhonophyllinae						
Rhinophylla Peters 1865						
Rhinophylla alethina Handley 1966	pac	ant cau vc	cho	0-1000	Handley 1966	AMNH FMNH ICN MHNUC MZCH NMNM (holotype) UV
Rhinophylla fischerae D. C. Carter 1966	amz	ama caq cau gn	met pu	0-500	Marinkelle & Cadena 1972	FMNH IAvH ICN 5161TTU
Rhinophylla pumilio Peters 1865	amz ori	ama caq cau gn met pu vi	gn va	0-500	Barriga-Bonilla 1965	MHNU IAvH ICN 671 TTU UV

Table 1. (cont.)

Taxa	Region	Departments (records from reviewed literature)	Departments (records from museums)	Elevational range	Reference	Collections
Subfamily Glyphonycterinae						
Glyphonycteris Thomas 1896 § (10)						
Glyphonycteris sylvestris (Thomas 1896)	amz car	ant caq	co	15-1100	Montengro and Romero-Ruiz 2000	ICN 172392
Neonycteris Sanborn 1949						
Neonycteris pusilla (Sanborn 1949) + § (11)	amz	va		0-500	Sanborn 1949	AMNH 78830 Brazil-Colombia
Trinycteris Sanborn 1949						
Trinycteris nicefori Sanborn 1949	amz and pac	caq cho nsn to vc	ama gn met	15-150	Sanborn 1949	AMNH holotype ICN MZCH UV
Subfamily Stenodermatinae						
Tribe Sturnirini						
Sturnira Gray 1842						
Sturnira aratathomasi Peterson and Tamsitt 1968	and	ant cau cl ri	vc	1600-2800	Peterson & Tamsitt 1968	IAvh UV ROM (holotype) USNM
Sturnira bidens (Thomas 1915)	and	ant cau cl cho na ri to	bo hu met qui vc	1800-3100	Marinkelle & Cadena 1972	IAvH ICN 1700 ROM MHNU MHNUC UV
Sturnira bogotensis Shamel 1927	and	ant na to	cun met ris	1500-3100	Shamel 1927	IAvH ICN MUD USNM holotype
Sturnira erythromus Tschudi 1844	and	ant cau cl nar ri snt to	bo cas ce cun ma met nsn qui to vc	1800-3500	Lemke et al. 1982	FMNH IAvH ICN 5365 MHNUC TTU USNM UV
Sturnira koopmanhilli McCarthy and Albuja 2006 + § (12)	and pac	ant cau cho na		1000-1500	McCarty, Albuja, and Alberico 2006	MHNUC MZCH UV 4442
Sturnira lilium (E. Geoffroyi St. Hilaire 1810)	co	ant cau cho cun gn ma na ri snt to vc	ama bl bo cl cas gn gua hu met nsn pu su va	0-1900	Hershkovitz 1949	IAvH ICN 683 MHNUC MUD MZCH TTU UV
Sturnira luisi Davis 1980	and pac	ant cau cho to vc	atl ce met snt	0-500	Alberico & Negret 1992	FMNH ICN MHNUC MZCH USNM 499420UV
Sturnira magna de la Torre 1966	amz	ama cau gua met pu	gv	0-500	Marinkelle & Cadena 1972	FMNH ICN 6880 MHNU UV
Sturnira mistratensis Contreras-Vega and Caden, 2000 + •	and	ri		980	Contreras and Cadena 2000	ICN holotype
Sturnira oporaphilum Tschudi 1844 § (13)	and pac	ant cau cl cun na ri snt to vc	bo ce hu met nsn pu vc		Valdivieso 1964	AMNH FMNH ICN MHNUC MUD TTU USNM 483510 UV
Sturnira tildae de la Torre 1959	amz and ori	ama ant gn met pu to	bo caq cun gn ri va vi	0-500	Marinkelle & Cadena 1972	IAvH ICN 5206 MUD TTU UV
Tribe Stenodermatini						
Subtribe Vampyrissina						
Chiroderma Peters 1860						
Chiroderma salvini Dobson 1878	and pac	ant caq cau cl cho na snt to	ce met pu ri vc	0-2000	Dobson 1880	FMNH IAvH ICN 6193 MHNUC MZCH USNM UV
Chiroderma trinitatum Goodwin 1958	amz car pac	ant caq cau cho gn	ama bo ce ma snt va vc vi	0-500	Barriga-Bonilla 1965	FMNH IAvH ICN 18852 MZCH TTU USNM UV
Chiroderma villosum Peters 1860	amz car pac	ant caq cau cho ma na vc	ama ara met pu va	0-500	Allen 1900	AMNH FMNH IAvH ICN 2188 USNM UV

Table 1. (cont.)

Taxa	Region	Departments (records from reviewed literature)	Departments (records from museums)	Elevational range	Reference	Collections
Platyrrhinus Saussure 1860						
Platyrrhinus albericoi Velazco 2005+	and ori	met	ant bo cun ma nsn qui ri snt vc	1000 - 1800	Velazco 2005	IAvH ICN 8151 MUA USNM
Platyrrhinus aquilus (Handley and Ferris 1972) +	car			0-500	Velazco in press	
Platyrrhinus brachycephalus (Rouk and Carter 1972)	amz	ama ara caq met	bo cas cl co cun hu pu ri va	0-500	Rouk and Carter 1972	FMNH IAvH ICN 121261 MZCH TTU USNM UV
Platyrrhinus chocoensis Alberico and Velasco 1991	pac	cau cho	na vc	0-1000	Alberico & Velasco 1991	FMNH ICN IAvH MHNUC MZCH USNM UV holotype
Platyrrhinus dorsalis (Thomas 1900)	co	ant caq cau cl cho cu na ri to vc	bo cau cun hu met qui	1000-1300	Dobson 1878	FMNH IAvH ICN 656 KU MHNUC MUA MZCH TTU UV
Platyrrhinus helleri (Peters 1866)	co	ant caq cau cho cun gn met to	bo cl co hu ma na nsn pu qui ri snt vc va vi	0-1500	Sanborn 1955	FMNH IAvH ICN 13027 MZCH MHNUC MUA TTU USNM UV
Platyrrhinus incarum (Thomas 1912) +	amz	ama		0 -500	Velazco (in press)	USNM 483642
Platyrrhinus infuscus (Peters 1880)	amz	caq cau met pu	ama pu	0-1000	Marinkelle 1970	FMNH IAvH ICN MHNU TTU USNM UV
Platyrrhinus ismaeli Velazco 2005 +	and	hu	ant bo caq cun met nsn pu qui ri vc	1000-1500	Velazco 2005	FMNH 58733 IAvH ICN MUA USNM UV
Platyrrhinus nigellus (Gardner and Carter 1972) +	and car	ce na	bo caq cau cun hu ma met na nsn pu qui ri snt vc	620-2757	Velazco 2005	FMNH 6948 IAvH ICN USNM
Platyrrhinus umbratus (Lyon 1902) +	and car	ant ma to	bo ce cho cun hu ma ri snt vc	400-2550	Velazco (in press)	MUD holotype
Platyrrhinus vittatus (Peters 1859)	co	ant cau cl cun ma na ri to	ma met na vc	1000-3000	Allen 1900	AMNH 1500 IAvH ICN MHNUC MUD TTU UV
Platyrrhinus sp. nov. Velazco and Gardner (in press)	pac	cho, vc			Velazco and Gardner (in press)	
Uroderma Peters 1866						
Uroderma bilobatum Peters 1866	co	ant caq cl cho cun gn ma met	ama ara bl bo cas ce co cun hu gua ma met pu snt su to va vc	0-1500	Allen 1900	AMNH FMNH IAvH ICN 3993 MUD MZCH TTU USNM UV
Uroderma magnirostrum Davis 1968	co	ant caq cho met	ama bl caq cas cun gua me nsn to vc	0-500	Davis 1968	AMNH IAvH ICN 12661 MUD TTU USNM UV
Vampyressa Thomas 1900 § (14)+						
Vampyressa melissa Thomas 1926 § (15) +	amz and	caq hu na snt vc	ama cau met na pu ri snt vc	0-2000	Lemke et al. 1982 Ospina and Gómez 1999	FMNH IAvH 2282 ICN TTU
Vampyressa thyone Thomas 1909	co	ant caq cau cho gn ma na ri to vc	ama bo cl cun met pu snt va	0-1900	Thomas 1909	AMNH BMNH FMNH ICN MHNROM UC USNM 483735

Table 1. (cont.)

Taxa	Region	Departments (records from reviewed literature)	Departments (records from museums)	Elevational range	Reference	Collections
Vampiriscus Thomas 1900§ (14)						
Vampyriscus bidens (Dobson 1878) +	amz and	caq cau va	met pu	0-1000	Marinkelle & Cadena 1972	IAvH ICN 18646 ROM USNH UV
Vampyriscus brocki (Peterson 1968) +	amz	ama	ce ma	0-500	Baker et al. 1972	CSJ ICN 14913 UV IAvH ROM TTU
Vampyriscus nymphaea (Thomas 1909) +	pac	ant cau cho	ri vc	0-1900	Thomas 1909	AMNH FMNH ICN 16165 MHNUC MZCH USNM UV
Vampyrodes Thomas 1900						
Vampyrodes caraccioli (Thomas 1889)	co	cau cho gn	ant pu vc va	0-1000	Arata et al. 1968	FMNH IAvH ICN 11274 TTU USNM UV
Tribe Mesostenodermatini						
Subtribe Enchistenina						
Enchistenes Andersen 1906						
Enchistenes hartii Thomas 1892 +	co	ant caq cau cl cho na ri vc	ama bo cas cun met snt pu to	0-2000	Arata et al. 1968	FMNH ICN 6771 MHNUC MZCH TTU USNM
Subtribe Ectophyllina§ (16)						
Mesophylla Thomas 1901						
Mesophylla macconnelli Thomas 1901	co	ant caq cau cl cho ri vc gn	ama gn met na pu ri va vc vi	0-1500	Laurie 1955	FMNH IAvH ICN MZCH TTU USNM 499483 UV
Subtribe Artibeina						
Artibeus Leach 1821						
Artibeus amplus Handley 1987	and car	ant caq cau	bo ce ma met	0-1300	Handley 1987	IAvH ICN 13344 UV
Artibeus concolor Peters 1865 § (17) +	ama and	snt gn	ama caq gn va vi	0-500	Dobson 1880	IAvH ICN 15014 UV
Artibeus jamaicensis Leach 1821	car ori pac	ant cau cl cho cun ma ri to vc	bl bo cl cas ce co cun ma met nsn sand pro	0-2100	J.A. Allen 1890	AMNH FMNH IAvH ICN MHNUC MUD MZCH ROM TTU USNM 499488 UV
Artibeus lituratus (Olfers 1818)	co	ant cau cl cho cun ma met snt to	ama ara bo cas ce co gn gua hu na nsn pu qui ri snt to vc va vi	0-2600	Dobson 1878	AMNH FMNH IAvH ICN 447 MHNUC MUD MZCH TTU USNM UV
Artibeus obscurus (Schinz 1821)	amz and	ant cau met gn	ama ara cl caq gn met ri va yi	0-1000	Muñoz 1986	FMNH 113407 IAvH ICN TTU USNM UV
Artibeus planirostris (Spix 1823)	amz and ori	caq	ama cun hu met nsn pu snt vi	0-1300	Koopman 1982	IAvH ICN 17307 TTU UV
Dermanura Gervais 1856 + § (18)						
Dermanura anderseni (Osgood 1916) +	amz	ama	ama ant bl caq ce cho co cun met nsn	0-500	Cuervo et al 1986	ICN 17180 ROM 63061
Dermanura bogotensis (Andersen 1906) +	and	cun	ce ri	2600	Acta chiropterologic a	ICN holotype
Dermanura glauca (Thomas 1893) +	co	caq cau cl cho cun ma met snt	ant	0-2100	Dobson 1880	IAvH ICN MHNUC UV

Table 1. (cont.)

Taxa	Region	Departments (records from reviewed literature)	Departments (records from museums)	Elevational range	Reference	Collections
Dermanura gnoma (Handley 1987) +	amz	caq	ant	0-600	Muñoz-Saba 1999	IAvH ICN UV MHN ROM UC 545
Dermanura phaeotis Miller 1902 +	and car pac	ant cau cl cho na ri vc	ce co ma qui	0-1700	J.A. Allen 1916	FMNH 113998IAvH ICN MHNUC MZCH TTU UV
Dermanura rava Miller 1902 +	and pac	cho		0 -1000	Solari et al. 2008	ICN 8738
Dermanura tolteca (Saussure 1860) +	and pac	ant cau snt	ri	1500-2500	Cuervo et al 1986	ICN 11516 MHNUC
Dermanura watsoni (Thomas 1901) +	and pac	cau cho met	ant na vc	0 - 1000	Solari et al. 2008	AMNH BM ICN MZCH MHNUC 650 ROM TTU
Subtribe Stenodermantina						
Ametrida Gray 1847						
Ametrida centurio Gray 1847	amz		vi	0-500	Alberico et al. 2000	ICN 13983
Sphaeronycteris Peters 1882						
Sphaeronycteris toxophyllum Peters 1882	amz and car	ama cun met snt	caq ma va vi	0-2600	Sanborn 1941	IAvH ICN 499 ICN 499 TTU UV

Additional genetic data will undoubtedly provide higher resolution and possibly indicate other taxonomic changes, but at this point in time these molecular-based trees are the best supported classifications available and are appropriately used as a starting point to understand the diversity, evolution of morphology and karyotypes, ecological associations, and other aspects of the biology of New World leaf-nosed bats.

List summary.—We report 118 confirmed phyllostomid species for Colombia (Table 1) and 14 species potentially present in the country (Table 2) for a total of 132 species representing 40 genera and10 subfamilies. All known phyllostomid subfamilies are represented in Colombia, with the exception of the subfamily Macrotinae (not present in South America). At 118 known species, Colombia has the greatest number of bat species of phyllostomid bats of any country, surpassing countries of larger geographic area and greater overall mammalian diversity such as Brazil, Mexico, and Peru (Table 3). The number of phyllostomid species reported for Colombia is expected to increase in the near future as a result of intensive field work (e.g., conducted by Colombian museums and scientists), as well as revisionary systematics of phyllostomid bats.

Taxonomic comments.—Eighteen taxonomic comments (designated by § in Table 1) are included: (1) We follow Lee et al. (2002) and identify as members of the genus *Lophostoma*: *L. brasiliense*, *L. carrikeri*, and *L. silvicolum*, which were included as members of the genus *Tonatia* by Alberico et al. (2000). (2) We follow Simmons and Voss (1998) and recognize *Mimon cozumelae* Goldman 1914 as a different taxon from *M. bennettii*. Alberico et al. (2000) recognized *Mimon* specimens from Chigorodó, Antioquia, originally reported as *M. cozumelae* by Marinkelle and Cadena (1972), as *M. bennettii*. *Mimon* specimens from Chigorodó reported in Marinkelle and Cadena (1972) were deposited at the USNM collections and the Museum of Natural History of the Universidad de los Andes in Bogotá (MHNU), acronym used in Marinkelle and Cadena (1972). *Mimon bennettii* specimen(s) from the department of Meta, on the eastern versant of the Colombian Andes, reported by Alberico et al. (2000) should correspond to the material supposedly deposited at the AMNH by Marinkelle and Cadena (1972). However, after mining the collection database of the AMNH we were not able to find Colombian specimens of *M. cozumelae* or *M. bennettii*. (3) We follow Simmons and Voss (1998) and treat *Choeroniscus intermedius* J.A.

Table 2. Species potentially present in Colombia. Abbreviations for Colombian regions are the same as those used in Table 1. Abbreviations of countries: Ecuador (ecu); Peru (per); Venezuela (ven). Elevations in meters.

Taxa	Region	Elevational range	Reference	Country
Subfamily Micronycterinae				
Micronycteris brosseti Simmons and Voss 1998	amz	0-500	Simmons and Voss 1998	per
Micronycteris giovanniae Baker and Fonseca 2007	pac	0-500	Fonseca et al. 2007	ecu
Micronycteris homezi Pirlot 1967	and ori	0-1500	Pirlot 1967	ven
Micronycteris matses Simmons et al. 2002	amz	0-500	Simmons et al. 2002	per
Subfamily Lonchorhininae				
Lonchorhina fernandezi Ochoa and Ibañez 1982	amz ori	0-500	Ochoa and Ibañez 1982	ven
Lonchorhina inusitata Handley and Ochoa 1997	amz ori	0-500	Handley and Ochoa 1997	ven
Subfamily Phyllostominae				
Lophostoma aequatorialis Baker et al. 2004	pac	0.800	Baker et al 2004	ecu
Lophostoma yasuni (Fonseca and Pinto 2004)	amz	0-500	Fonseca and Pinto 2004	ecu
Subfamily Lonchophyllinae				
Lonchophylla orcesi Albuja and Gardner 2005	pac	0-1000	Albuja and Gardner 2005	ecu
Lonchophylla pattoni Woodman and Timm 2006	amz	0-500	Woodman and Timm 2006	per
Subfamily Glyphonycterinae				
Glyphonycteris daviesi Hill 1965	amz ori	0-1000	Gardner 2008	bra per ven
Subphamily Stenodermatinae				
Platyrrhinus aurarius Handley and Ferris 1972	amz ori	700-2200	Velazco 2005	ven
Platyrrhinus matapalensis Velazco 2005	pac	200-1500	Velazco 2005	ecu
Dermanura rosenbergi Thomas 1897	pac	0-1000	Hoofer et al. 2008	ecu

Table 3. Number of phyllostomid species by country, as reported in the most recently updated literature.

Country	Number of species	Reference
Colombia	118	This work
Brazil	90	dos Reis et al. (2007)
Venezuela	88	Linares (1997)
Peru	88	UICN (2009)
Ecuador	86	Tirira (2007)
Bolivia	72	Aguirre (2008)
Costa Rica	63	LaVal and Rodríguez (2002)
Mexico	55	Ceballos and Oliva (2005)
Paraguay	20	López-González (2005)
Argentina	17	Barquez et al. (1999)

Allen and Chapman 1893 as a junior synonym of *C. minor*. (4) Alberico et al. (2000) made reference to the holotype of *Lichonycteris obscura* (type locality Managua, Nicaragua) with a Colombian origin. This may be an editorial mistake and the authors may have been referring to the holotype of *Lionycteris spurrelli* which is adjacent to *L. obscura* in their list. The holotype of *L. spurrelli* is deposited in the BM (BM-13.8.10.1) and was collected in Condoto, Chocó, Colombia (Carter and Dolan 1978). (5) We follow Alberico et al. (2000) and include *Scleronycteris ega* Thomas 1912 as present in Colombia. However, we failed to find the museum material supposedly deposited at the IAvH supporting the hypothesis by Alberico et al. (2000). Further investigation is necessary to confirm the presence of this taxon in Colombia. (6) Alberico et al. (2000) followed the criteria of Handley (1966) and reported *L. mordax* for Colombia; *Lonchophylla mordax* was restricted to southeastern South America by Albuja and Gardner (2005). We follow Albuja and Gardner (2005) and treat Colombian populations of *Lonchophylla* previously identified as *L. mordax* as *L. concava*. (7) Griffiths and Gardner (2008) restricted the distribution of *L. handleyi* to Peru and reassigned *L. handleyi* records reported by Alberico and Orejuela (1992) as *L. chocoana*. We report a record of *L. handleyi* from Huila deposited at the collections of the MHNUC. (8) Dávalos and Corthals (2009) extended the distribution of *L. orienticollina* on the western side of the Eastern Cordillera of the Colombian Andes. The direct analysis of the morphology of specimen ICN 16238 from the western versant of the Eastern Cordillera, included in the type series of *L. orienticollina*, revealed that this specimen does not differ from typical *L. robusta*. Further research is necessary to determine the actual limits of these two taxa in Colombia. (9) We follow McLellan and Koopman (2008) and treat *Carollia colombiana* Cuartas et al. 2001, with type locality La Cejita road, Barbosa, Antioquia, Colombia, as junior synonym of *C. castanea*; (10) Although *Glyophonycteris daviesi* (Hill 1965) was included in Alberico et al. (2000), the authors did not provide information on museum material supporting its presence in Colombia. However, *G. daviesi* has been documented for Brazil, Ecuador, Peru, and Venezuela from localities adjacent to Colombia and holding environments similar to those typical of the Colombian Amazon and Orinoquia. (11) Alberico et al. (2000) did not provide a catalogue number for *Neonycteris pusilla* (Sanborn 1949) specimens deposited at the AMNH. Alberico et al. (2000) may refer to specimens AMNH 78830-31 in the type series of the species, from Tahuapunta, Río Vaupes, at the Colombian border, Amazonas Brazil, collected by the Olalla brothers on 14 July 1929 (Sanborn 1949). (12) Specimens reported by Alberico et al. (2000) as *Sturnira mordax* are treated as *S. koopmanhilli* following the criteria proposed by McCarthy et al. (2006). (13) We follow Gardner (2008) in considering *Sturnira ludovici* as a subspecies of *S. oporaphilum* (*S. o. ludovici*). *Sturnira ludovici* was treated as a species by Alberico et al. (2000). (14) We follow Baker et al. (2003) and recognize as members of the genus *Vampyriscus*: *V. bidens*, *V. brocki*, and *V. nymphaea*, previously included in the genus *Vampyressa* by Alberico et al. (2000). (15) We follow Lim et al. (2003) and consider Colombian specimens previously identified as *V. pusilla* as *V. thyone*. Gardner (2008) confined the distribution of *V. pusilla* to southern Brazil and Paraguay. (16) Alberico et al. (2000) recognized *Ectophylla alba* as present in Colombia based on material deposited at the UV with no catalogue number provided in their publication. We could not find specimens of *E. alba* supposedly deposited at the UV; in this work we follow Gardner (2008) who restricted *E. alba* to Central America. It is likely that Colombian *E. alba* specimens reported by Alberico et al. (2000) correspond to *Mesophylla macconnellii*. (17) We follow Hoofer et al. (2008) and recognize *Koopania concolor* as *Artibeus concolor*. (18) We follow Hoofer et al. (2008) in considering *Dermanura* as a distinct genus from *Artibeus*; Alberico et al. (2000) considered *Dermanura* as a subgenus within *Artibeus*. A large number of *Dermanura* specimens deposited in Colombian collections (i. e. 236 of the specimens in our database of the ICN collection) have been misidentified as *D. cinerea*, an epithet which enclosed *D. anderseni*, *D. cinerea*, *D. glauca*, *D. gnoma*, and *D. watsoni*, as mentioned by Gardner (2008).

Newly described and elevated species.—We included in our lists 27 newly recognized species (19 newly described species and eight newly elevated species), 19 of which are confirmed for Colombia, while eight are potentially present (*) in the country. The new species are as follows: *Micronycteris matses** Simmons et al. 2002 with type locality in Nuevo San Juan, Loreto, Peru; *M. brosseti** Simmons and Voss 1998 with type locality in Paracou, French Guiana; *M.*

*giovanniae** Baker and Fonseca 2007 with type locality in Esmeraldas San Lorenzo (toward Lita), Finca San Jose, Ecuador; *Lophostoma aequatorialis** Baker et al. 2004 with type locality in Estación Experimental La Chiquita, near San Lorenzo, Esmeraldas, Ecuador; *L. yasuni** (Fonseca and Pinto 2004) with type locality in the vicinity of Yasuní Research Station, Yasuní National Park and Biosphere Reserve, Orellana, Ecuador; *Anoura aequatoris* with type locality in Illambo Gualea, Ecuador (Lönnberg 1921) a former subspecies of *A. caudifer* elevated by Mantilla-Meluk and Baker (2006) and confirmed in Colombia by the same authors; *A. cadenai* Mantilla-Meluk and Baker 2006 with type locality in Calima, Valle del Cauca; *A. fistulata* Muchhala et al. 2005 described from Condor Mirador, Ecuador, reported for Colombia by Mantilla-Meluk and Baker (2008) and Mantilla-Meluk et al. (2009); *A. luismanueli* Molinari 1994 with type locality in Mérida, Venezuela, confirmed in Colombia by Mantilla-Meluk and Baker (2006). Alberico et al. (2000) mentioned *Perez?* (unknown date) as bibliographic reference for *A. luismanueli* in Colombia; this work corresponds to a draft never published based on preliminary identifications (some of which were made by the senior author as a student at the ICN). Mantilla-Meluk et al. (2009) provide additional information on the taxonomic differentiation between *A. aequatoris* and *A. luismanueli* in Colombia; *Lichonycteris degener* Miller 1931 with type locality in Pará, Belém, Brazil, recognized as a different taxon from *L. obscura* by Gardner (2008). The only published reference of a Colombian specimen of *L. degener* is found in Montenegro and Romero-Ruiz (2000); *Lonchophylla cadenai* Woodman and Timm 2006 with type locality in Buenaventura, Valle del Cauca; *L. chocoana* Dávalos 2004 with type locality in the vicinity of Alto Tambo, Ecuador; *L. orcesi** Albuja and Gardner 2005 with type locality in Las Pambiles, Río Piedras, Cordillera de Toisán, Esmeraldas, Ecuador; *L. orienticollina* Dávalos and Corthals 2009 with type locality at the intersection of Caño Guamalito and Caño La Curia, Meta, Colombia; *L. pattoni** Woodman and Timm 2006 with type locality in Reserva Cusco Amazónico, north bank Río Madre de Dios, 14 km east Puerto Maldonado, Tambopata, Peru. The inclusion of *L. pattoni* within the list of species potentially present in the Colombia was based on specimens that partially matched *L. pattoni* description from Leticia, Amazonas deposited at the ICN; however, further review is necessary to confirm its presence in the country. In addition, the distribution of *L. pattoni* was recently extended to Ecuadorian province of Pastaza (Mantilla-Meluk et al. 2009) in the Ecuadorian Amazon that shares the ecological characteristics of the Colombian southern Amazon; *Carollia monohernandezi* Cuartas and González 2004 with type locality in Villaraz, Florencia, Caquetá, Colombia; *Sturnira koopmanhilli* McCarthy et al. 2006 with type locality in Las Pambiles, Reserva Ecológica Cotacachi-Cayapas, Esmeraldas, Ecuador; *S. mistratensis* Contreras and Cadena 2000 type locality in Puerto de Oro, Risaralda, Colombia; *Platyrrhinus albericoi* Velazco 2005 with type locality in San Pedro, Paucartambo-Pilcopata road, Department of Cuzco confirmed in Colombian by Velazco et al. (in press); *P. aquilus* (Handley and Ferris 1972) with type locality in the head of Río Pucro, 4,100 ft Cerro Mali, Darién, Panama elevated and confirmed in Colombia by Velazco and Gardner (in press); *P. incarum*, previously considered a subspecies of *P. helleri* (*Vampyrops zarhinus incarum*) (Thomas 1912) with type locality in Posuzo, Pasco, Peru, elevated to species and confirmed in Colombia by Velazco et al. (in press) based on material from Leticia, Amazonas; *P. ismaeli* Velazco 2005 with type locality in Balsas, Chachapoyas, Amazonas Peru; *P. matapalensis** Velazco 2005 with type locality in Matapalo, Zarumilla, Tumbes, Peru; *P. nigellus*, described as *Vampyrops nigellus* by Gardner and Carter (1972) with type locality in Huahuanchayo, Ayacucho, Peru, elevated and confirmed in Colombia by Velazco (2005); *P. umbratus* (Lyon 1902), recognized by Simmons (2005) with type locality in San Miguel, Macotama River, Magdalena Colombia; *P. sp. nov.* (Velazco and Gardner in press) described from the Biogeographic Chocó region of Colombia and Ecuador and closely related to *P. vittatus*; *Dermanura bogotensis* (Andersen 1906) with type locality in Curiche, near Bogotá, Cundinamarca, Colombia, elevated by Lim et al. 2008; *D. rosenbergi** Thomas 1897 potentially present in Colombia, with type locality in Cachaví, Esmeraldas, Ecuador, elevated by Solari et al. (in press); this taxon was previously considered a junior synonym of *D. glauca* by Simmons (2005) and included under the genus *Artibeus* (as *A. glaucus*) by Alberico et al. (2000).

Models of potential distribution.—Models of potential distribution of phyllostomid species present and potentially present in Colombia are shown in Appendix I and II, respectively. The models of potential distribution of species of dubious records in Colombia such as *N. pusilla* and *S. ega* were included within Appendix II. Our models of potential distribution represent the first attempt to incorporate the available computational technology, particularly Geographic Information Systems (GIS), to produce more biologically meaningful predicted distributions for a large set of geographically related phyllostomid species, using a homogeneous analytical procedure which allows repeatability and improvement. The procedure allowed us to more rigorously delineate potential distributional limits in comparison with previous efforts using only marginal records, such as those by Patterson et al. (2007) and Gardner (2008). Although for some species the models could overestimate the actual distribution, the methodology may prove useful in delimiting distributional ranges of Colombian phyllostomids. Models of potential distribution of Colombian phyllostomid bats presented in this work are available in various formats (grid, ascii, pdf, and jpeg) at the website of the Natural Science Research Laboratory, Museum of Texas Tech University (www.nsrl.ttu.edu).

General phyllostomid distributional patterns.—The Colombian territory is ecosystemically diverse due to a combination of complex geologic, ecological, and biogeographic processes that result in a variety of niche opportunities for phyllostomid bats. One of the most remarkable aspects of the Colombian geography is its location in the northwestern corner of South America, adjacent to and communicating with the Panamanian Isthmus. Northwestern South America has been identified as the epicenter of the great bidirectional exchange of fauna between North and South America during the Late Tertiary (Hershkovitz 1972). In addition, the proximity of the Colombian territory to putative centers of speciation in South America, Central America, and the Caribbean (Hershkovitz 1972) has contributed not only to the high number of species reported for Colombia, but also to the complexity of regional species arrangements found in our analyses. The geographic diversity of the Colombian territory can be divided into five natural regions as follows: Amazon, Andean, Caribbean, Orinoquia, and Pacific (Chocó), each one characterized by unique arrangements of ecological variables (Hernández Camacho et al. 1992). Our analyses associated the greatest number of species with the Andean (85 species) and Amazon regions (74 species), followed by the Pacific with 64 species, the Caribbean with 62 species, and the Orinoquia with 41 species (Table 4). Although a large number of species were shared among regions (Table 4), some species were documented from only one region (Appendix IV) as follows: Amazon region, 14 unique species, including the debated *N. pusilla* and *S. ega*; Andean, 12; and Pacific, 7.

Multiple correlation analyses between phyllostomid richness and environmental variables showed that phyllostomid richness in Colombia had a significant, positive correlation with temperature and precipitation and a significant and negative correlation with elevation (Table 5). The higher numbers of species were found in areas with average precipitation greater than 2,000 mm, average temperature greater than 25°C, and elevations lower than 1,000 m (Fig. 1a,b and Cover Figure) (Table 5). The above mentioned conditions are common across the country and dominate the lowland forested areas of the piedmonts of the Andean system and the Amazon regions.

The comparison between results from our regional species counting and results on species accumulation in our richness model suggests a greater geographic partitioning among species distributed along the Andean region with respect to the Amazon region. Although the overall number of species potentially present in the Andean region was greater than that in the Amazon region, the potential number of sympatric species per unit of area in our richness model was greater in the Amazon. The pattern observed in our richness model can be related to the environmental heterogeneity typically associated with elevational ranges, as well as the lower area occupied by potentially suitable environments. Conversely, stratified forests prevalent in the lowlands of Colombia are widely distributed across the Amazon offering multiple niche opportunities for phyllostomid bats, particularly for animalivorous and frugivorous forms (Medellín et al. 2000; Jiménez-Ortega and Mantilla-Meluk 2008). The greatest concentration of species in our species richness model occurred on the Guiana-Amazon corridor (Cover Figure). This corridor is characterized by terraces (200 to 500 m) of Cambric origin associated with the Guiana Shield. We hypothesize that these terraces constituted emergent land masses that recruited bat species during the repeated invasions of water masses on the lowlands of northwestern South America during the Miocene.

Table 4. Comparisons of phyllostomid species composition among Colombian natural regions.

	Species	Unique Species	Andean	Caribbean	Orinoquia	Pacific
Amazon	74	14	50	46	40	41
Andean	85	12	-	56	36	51
Caribbean	62	0	-	-	36	46
Orinoquia	41	0	-	-	-	35
Pacific	64	7	-	-	-	-

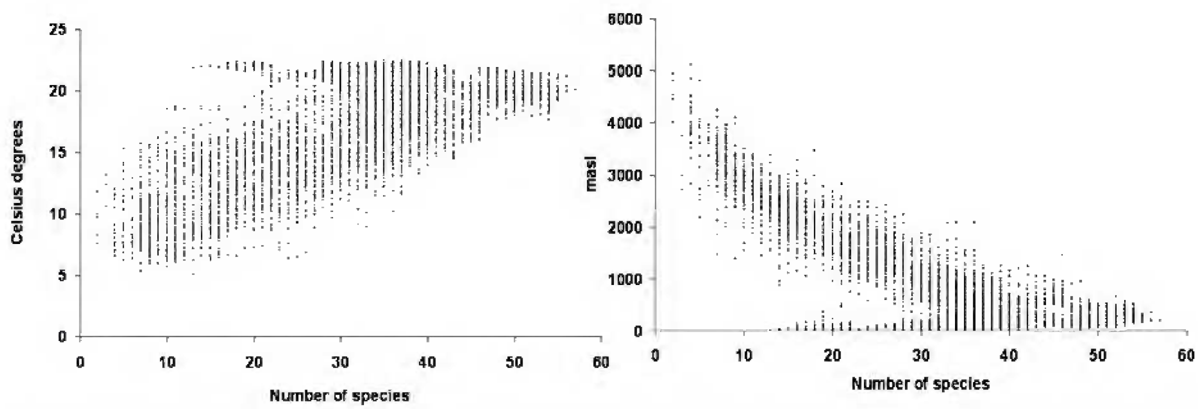

Figure 1. Scatter plots showing the positive correlation between phyllostomid species richness in Colombia, expressed in number of species, and mean annual temperature of the coldest month of the year, expressed in Celsius degrees (left); and the negative correlation between phyllostomid species richness in Colombia, expressed in number of species, and elevation, expressed in meters above sea level (right).

*Table 5. Results of Spearman correlation between richness and environmental variables (** significant at p>0.01). Correlations were based on values extracted from raster layers (N = 14,560). MAP = mean annual precipitation; TCMY = mean annual temperature of the coldest month of the year.*

	Richness	Elevation	MAP	TCMY
Richness	0			
Elevation	-0.38978 **	0	1.4565E-29	
Precipitation	0.37947 **	-0.10209	0	9.4415E-56
Temperature	0.48327 **	-0.76253	0.14187	0

For a significant period of the early to mid Miocene (23-17 Mya), the Colombian Amazon was under the influence of the lake formation of Pebas (Wesselingh and Salo 2006). Posterior inundations were apparently frequent during the mid and late Miocene (Hovikoski et al. 2007, and references in there) and elevations greater than 200 m could play an important role in the establishment of forested environments typically preferred by phyllostomids.

Among Colombian regions, the Andean, the Caribbean, and the Pacific were most similar in terms of species composition (Fig. 2a) (Table 4). High levels of similarity among the Andean, Caribbean, and Pacific regions are the consequence of the convergence of species distribution in the northwestern corner of the country. This portion of the country is flanked by the Pacific Ocean and the Caribbean Sea, and it is isolated from the eastern portion of country by the highland of the Andes. Hernandez-Camacho et al. (1992) identified the southwestern portion of the Colombian Caribbean as an independent ecological unit. Hernández-Camacho et al. (1992) divided the Caribbean into three zones: 1) the isolated mountainous system of the Sierra Nevada de Santa Marta; 2) the Arid Peri-Caribbean belt, with low precipitation, characterized by the presence of arid and semi arid environments; and 3) a region associated with the flooded fans of the Cauca and Magdalena Rivers. The latter zone is proposed to be ecologically connected with the northern portion of the Biogeographic Chocó constituting the Chocó-Magdalena Biogeographic zone. Mantilla-Meluk and Jimenéz-Ortega (2006) identified a latitudinal bat species turnover along the Colombian Biogeographic Chocó, and recognized the northern portion of the Colombian Pacific Coast as a biogeographic unit for chiropterans. In our models, phyllostomid lowland species distributed across the Pacific and the Caribbean regions in Colombia typically extended their distributions into adjacent Central America (i.e., *Dermanura phaeotis*, *D. rava*, and *D. watsoni*) (Solari et al. in press). The isolation of the western portion of Colombia caused by the highlands of the Andean system also is responsible for the distributional patterns observed among members of the subfamily Lonchophyllinae. Nectar feeders in the genus *Lonchophylla* are typical representatives of the Colom-

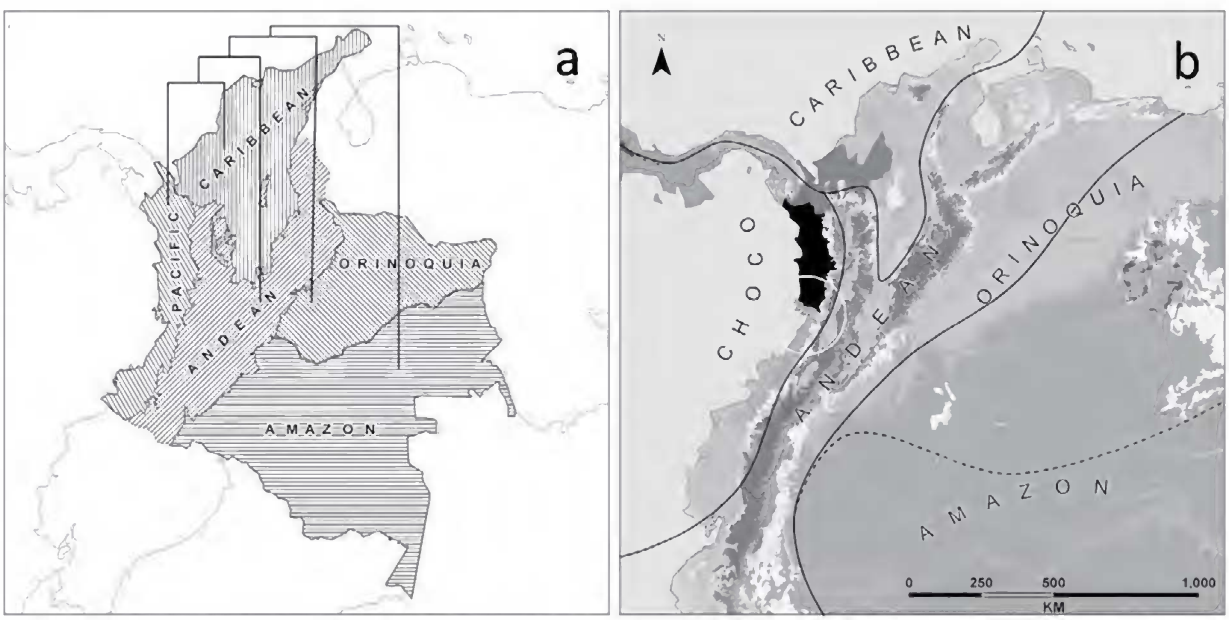

Figure 2. a) Colombian natural regions as defined by Hernández-Camacho et al. (1992) and phenogram of our hierarchical cluster analysis showing similarities in species composition among regions. b) Map of northwestern South America showing the potential biogeographic units for Colombian phyllostomid bats; dashed line shows the hypothetical division between the northern Colombian Amazon (Guianan Amazon) and the southern Colombian Amazon. Encircled area represents the southernmost limit of the hyper humid conditions of the Biogeographic Chocó (black), which acts as a filter of species on the western side of the country. The area in grey represents the most humid portion in the Caribbean region considered as an extension of the northern portion of the Biogeographic Chocó.

bian Chocoan fauna and several species extend their distribution into northern Ecuador (i.e., *Lonchophylla cadenai, L. chocoana, L. concava, L. fornicata* and *L. orcesi**) (Mantilla-Meluk 2007). This combination of common regional distributional patterns and phylogenetic affinities illustrate the influence of Colombian geography on the evolutionary history of the above mentioned groups. The formation of the Chocoan and Caribbean regions are relatively recent events associated with the final period of the Andean uplifting (5 to 3 Mya) and the creation of the Inter-Andean valleys and their associated flooded fans that filled the lowlands of primal northwestern South America (Martínez 1997; Ercilla et al. 2002). Prior to the final uplifting of the Andes, xerophytic environments associated with the effect of the Alisios winds extended their distribution along the northern coast of South America. The completion of the Isthmus of Panama and the deviation of the Humboldt marine current resulted in the predominant hyper-humid environments of Central Chocó (Fig. 2b). The presence of the Chocoan hyper-humid forest represents an ecological hiatus between the Central American-Caribbean dry corridor and the xerophytic forest in central and southern Ecuador. On its easternmost portion, xerophytic environments in the lowland of the Colombian Caribbean region are interrupted by the highlands of the Serranía del Perijá, which isolates the Colombian and the Venezuelan Caribbean coasts. It is likely that species with a Central American origin colonized the country following arid ecosystems, while it is plausible that species with a Guiana-Amazonian origin colonized western Colombia using the lowland passes of the pre-Andean system. The current predominant hyper-humid conditions of central Chocó constitute an additional natural barrier isolating phyllostomid populations from the southern Colombian Chocó and Ecuador.

The Colombian Andes play a double role as an effective barrier for isolating natural populations on the eastern and western versants of the system as well as a source of innumerable niche opportunities for phyllostomid bats, recruiting species from the other regions. Our analysis revealed that richness distribution among phyllostomids decreased with elevation, with a large number of species concentrated on the piedmonts of the Andes and few groups adapted to highland ecosystems (Cover Figure and Fig. 1b). Among phyllostomid highland specialists are representatives of the subtribe Anourina, genus *Anoura*, as well as representatives of the genera *Platyrrhinus* and *Sturnira*. All species in the genus *Anoura* are represented in Colombia (Mantilla-Meluk and Baker 2006, 2008) and have an apparent geographic subdivision thought to be associated with the uprising pattern of the three main units of the Colombian Andes. Ranges of highland phyllostomid specialists such as *Anoura, Platyrrhinus,* and *Sturnira* suggest that the Colombian Central and Western Cordilleras act as a single unit separated from the Eastern Coordillera by the Inter-Andean Valley of the Magdalena River.

The greatest difference in phyllostomid species composition among Colombian regions was found between the Pacific and the Amazon-Orinoquia regions, which are separated by the Andes (Table 4). Although several putative phyllostomid species have a trans-Andean distribution, molecular analyses conducted on conspecific populations from both versants of the Andes have resulted in the identification of higher levels of genetic differentiation than would be expected for conspecific taxa (Hoffman and Baker 2003; Baker et al. 2004; Baker and Bradley 2006; Velazco and Patterson 2008). The above mentioned studies concluded that the Andean system is an effective barrier to gene flow, thus promoting speciation.

The Colombian Orinoquia has the fewest number of phyllostomid species. The Llanos Orientales of the Colombian Orinoquia constitute a large low-lying plain, and among phyllostomid bats there are very few species specialized for use of open spaces. It appears that the open savannas of the Orinoquia do not offer many niche opportunities for phyllostomid forest specialists. The Colombian Orinoquia is characterized by dramatic fluctuations of ecological variables and the strong environmental gradient that prevails along its geography has an edaphic, rather than a climatic, basis: extensive sandstone areas in the east of Colombia provide a free-draining substrate, and hence a water-stressed environment for the vegetation that resulted in open tropical dry forest and steppe biomes (Marchant et al 2006).

Edaphic conditions of the Orinoquia prevent the development of stratified forest in the region. However, gallery forests are common on the margins of the water courses. We hypothesize that gallery forests have a limited carrying capacity for recruitment and establishment of species diversity typical of mature forests. In addition, climate in the Llanos Orientales can be classified as tropical diurnal with differences in monthly temperature generally small but with daily fluctuations that may be large (20˚C), especially during the dry season. The climate is dominated by the Inter-Tropical Convergence Zone (ITCZ) and moisture derived from the Atlantic Ocean. The two rainy seasons, from March to May and from October to December, are separated by dry seasons from January to February and from June to September. The average precipitation is 950 mm with an average of 175 mm in March; however, there is considerable variation (Berrio et al. 2003). Current climatic conditions observed on the savannas of the Colombian Orinoquia have dominated this region for at least 4000 years, since the Early and Middle Holocene (Marchant et al. 2006).

Status of the knowledge on Colombian phyllostomid bats.—As it is attested by results obtained in this work, the Colombian territory holds a unique and rich mammalian fauna, and a national plan for its study is urgently needed. An analysis of 17,778 phyllostomid bat museum records (Fig. 3) revealed a sampling bias of phyllostomids, primarily as a result of major Colombian academic centers being located within cities in the Andes and collecting localities being primarily adjacent to these cities. Many Colombian geographic areas and

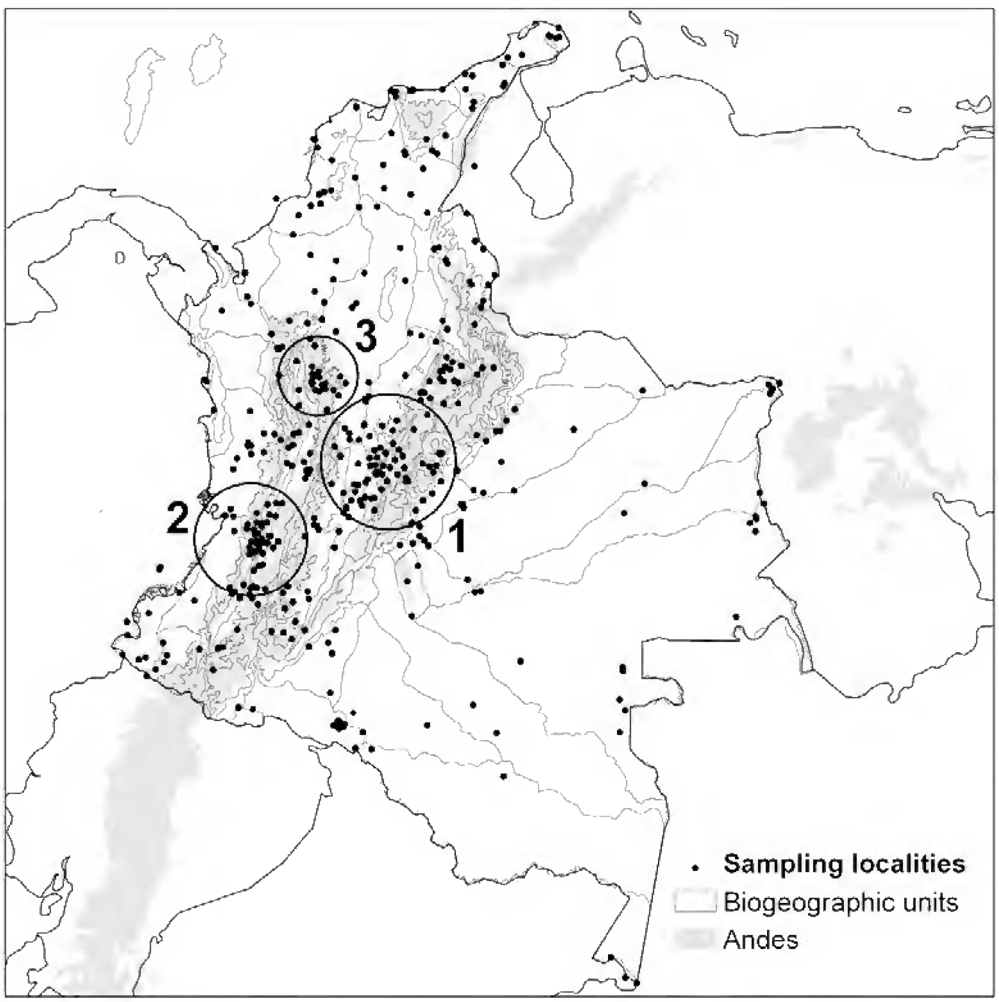

Figure 3. Map of Colombia showing the distribution of sampling localities of Phyllostomid bats associated with the 17,778 records analyzed in this study. Encircled areas represent the sampling bias of phyllostomids collecting localities primarily adjacent to major cities in Colombia as follows 1) Santafé de Bogotá, 2) Santiago de Cali, and 3) Medellín.

taxa remain underrepresented, and this is particularly true for areas and taxa that potentially contain the highest diversity of phyllostomid species. This work proves that the extensive collections of mammals deposited in Colombian institutions constitute an incredibly valuable resource. However, intense curatorial work is urgently required. We invite the international scientific community to validate these collections through their use as a scientific resource. Systematics is a rapidly developing field in South America (Voss 2009) and the participation of the international community is crucial for the development and consolidation of a proactive Colombian school in systematics and evolution. International institutions which have benefitted and enriched their own collections in the past with Colombian specimens, and South America for that matter, should create the mechanisms to facilitate access to specimens, particularly holotype material which greatly improve systematic studies in Colombia. We celebrate efforts by institutions such as the AMNH and TTU for leading the path in digitizing specimens made accessible via internet. We also applaud local efforts in documenting the Colombian mammalian diversity made by the various academic institutions holding collections. It is also remarkable the labor of the Instituto Alexander von Humboldt through the creation of the series of checklists of *Biota Colombiana*. In this work we follow Alberico et al. (2000) as well as the series of departmental checklists published in *Biota Colombiana* as primary source of reference for phyllostomid records. Initiatives like these ensure the generation of the knowledge required for the adequate conservation and management of Colombian natural resources. It is hoped this work will stimulate additional research to fulfill the gaps of information on Colombian phyllostomid bats identified herein.

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APPENDIX I

Models of potential distribution for confirmed Colombian phyllostomid species.

Lampronycteris brachyotis

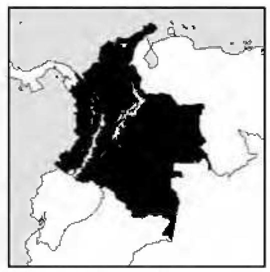
Micronycteris hirsuta

Micronycteris megalotis

Micronycteris microtis

Micronycteris minuta

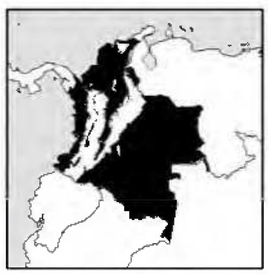
Micronycteris schmidtorum



Desmodus rotundus

Diaemus youngi

Diphylla ecaudata



Lochorhina aurita

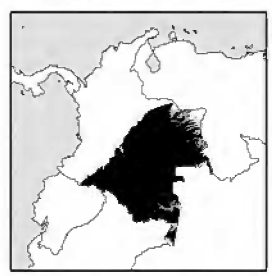
Lochorhina marinkellei

Lochorhina orinocensis

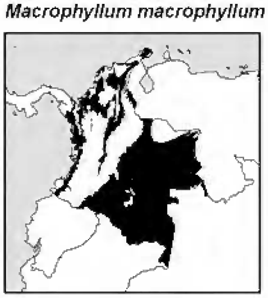
Macrophyllum macrophyllum

Trachops cirrhosus

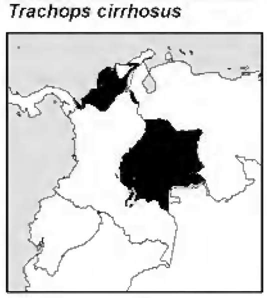
Lophostoma brasiliense



Lophostoma carrikeri



Lophostoma silvicolum



Mimon bennettii

Mimon cozumelae

Mimon crenulatum

APPENDIX I (CONT.)

Phylloderma stenops

Phyllostomus discolor

Phyllostomus elonagtus

Phylllostomus hastatus

Phyllostomus latifolius

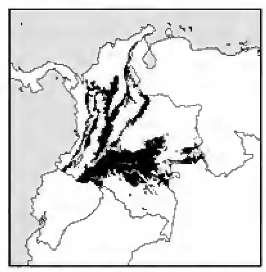
Tonatia saurophila

Chrotopterus auritus

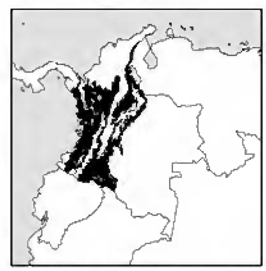
Vampyrum spectrum

Anoura aequatoris

Anoura cadenai

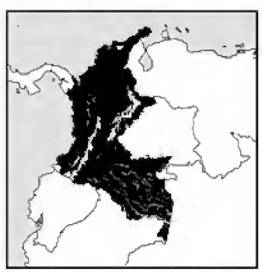


Anoura caudifer



Anoura cultrata

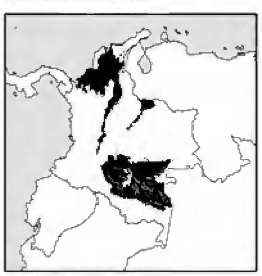
Anoura fistulata



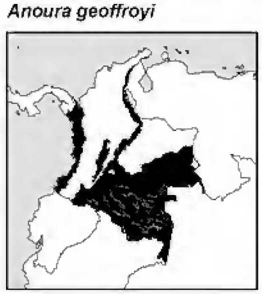
Anoura geoffroyi

Anoura latidens

Anoura luismanueli



Choeroniscus godmani



Choeroniscus minor

Choeroniscus periosus

Lichonycteris degener

APPENDIX I (CONT.)


Lichonycteris obscura

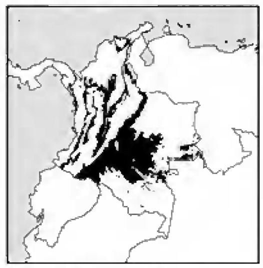

Scleronycteris ega


Glossophaga commissarisi


Glossophaga longirostris


Glossophaga soricina


Leptonycteris curasoe


Lionycteris spurrelli


Lonchophylla cadenai


Lonchophylla chocoana


Lonchophylla concava


Lonchophylla fornicata

Lonchophylla handleyi

Lonchophylla orienticollina


Lonchophylla robusta


Lonchophylla thomasi


Carollia brevicauda

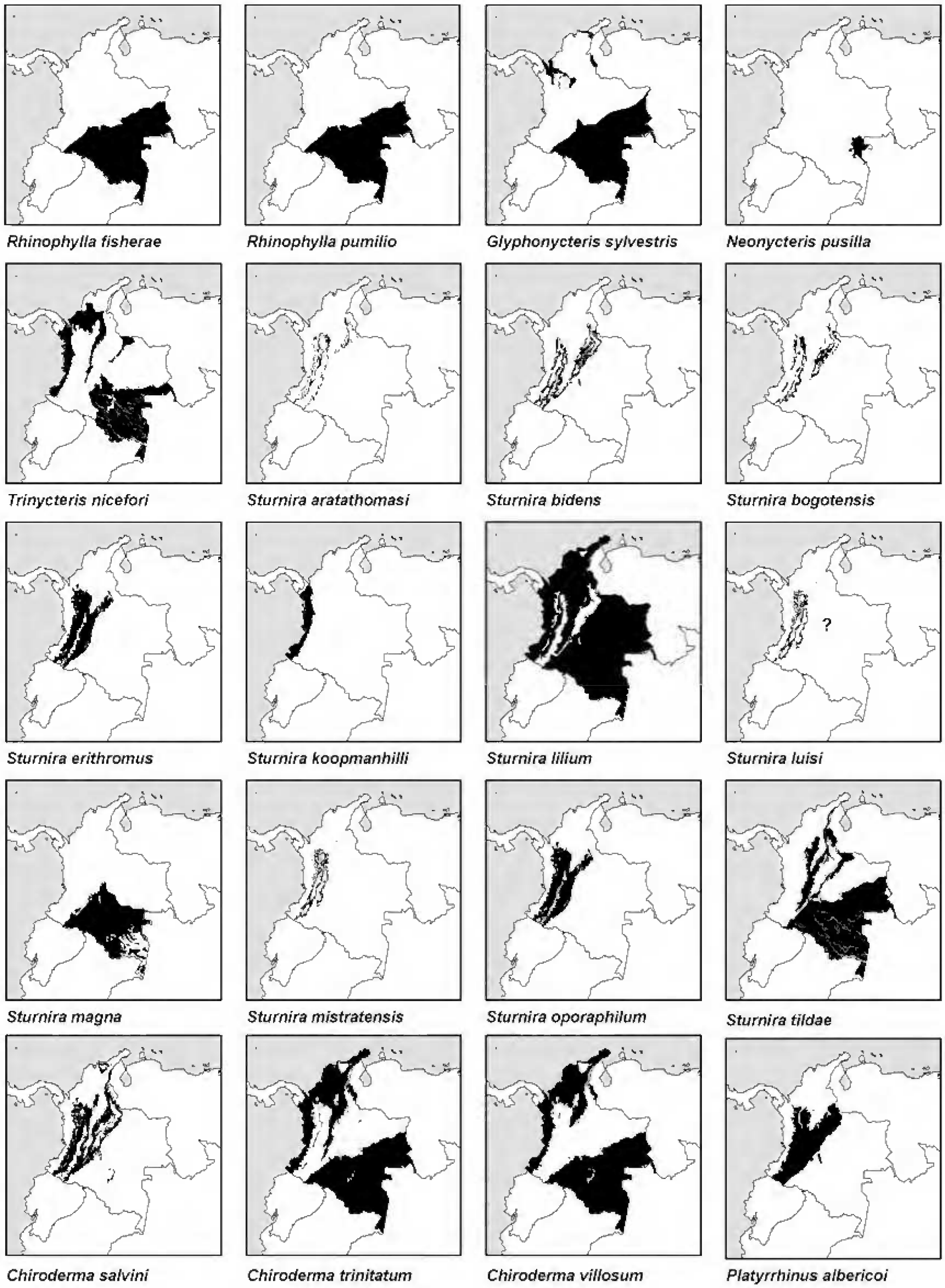

Carollia castanea


Carollia monohernandezi


Carollia perspicillata


Rhinophylla alethina

APPENDIX I (CONT.)



APPENDIX I (CONT.)


Platyrrhinus aquilus


Platyrrhinus brachycephalus


Platyrrhinus chocoensis


Platyrrhinus dorsalis


Platyrrhinus helleri


Platyrrhinus incarum


Platyrrhinus infuscus


Platyrrhinus ismaeli

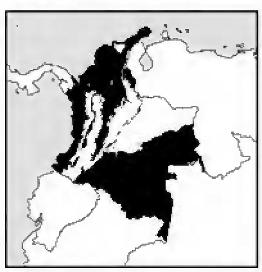

Platyrrhinus nigellus


Platyrrhinus umbratus

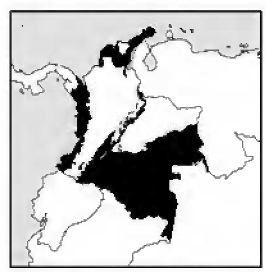

Platyrrhinus vittatus

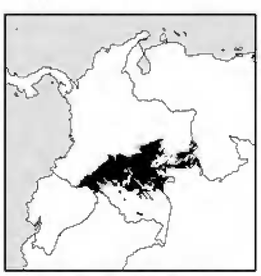

Platyrrhinus sp. nov.


Uroderma bilobatum


Uroderma magnirostrum

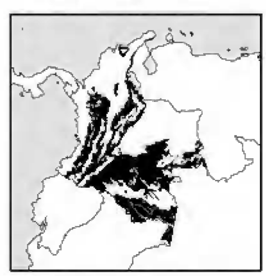

Vampyressa melissa


Vampyressa thyone

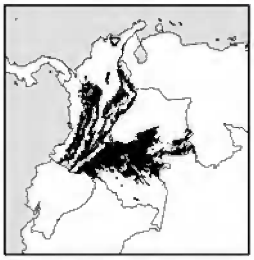

Vampyriscus bidens

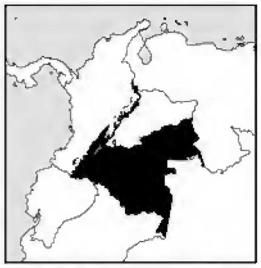

Vampyriscus brocki


Vampyriscus nymphaea


Vampyrodes caraccioli

APPENDIX I (CONT.)


Enchistenes hartii

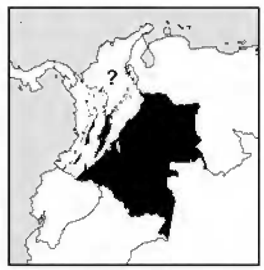

Mesophylla maconnelli


Artibeus amplus

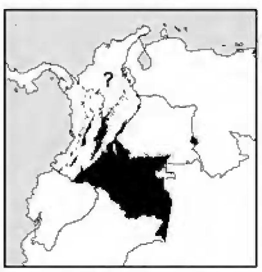

Artibeus concolor

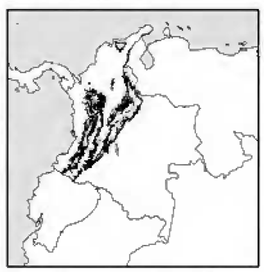

Artibeus jamaicensis

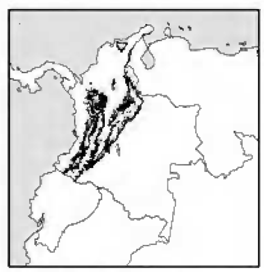

Artibeus lituratus


Artibeus obscurus


Artibeus planirostris


Dermanura anderseni


Dermanura bogotensis


Dermanura glauca


Dermanura gnoma


Dermanura phaeotis


Dermanura rava


Dermanura tolteca

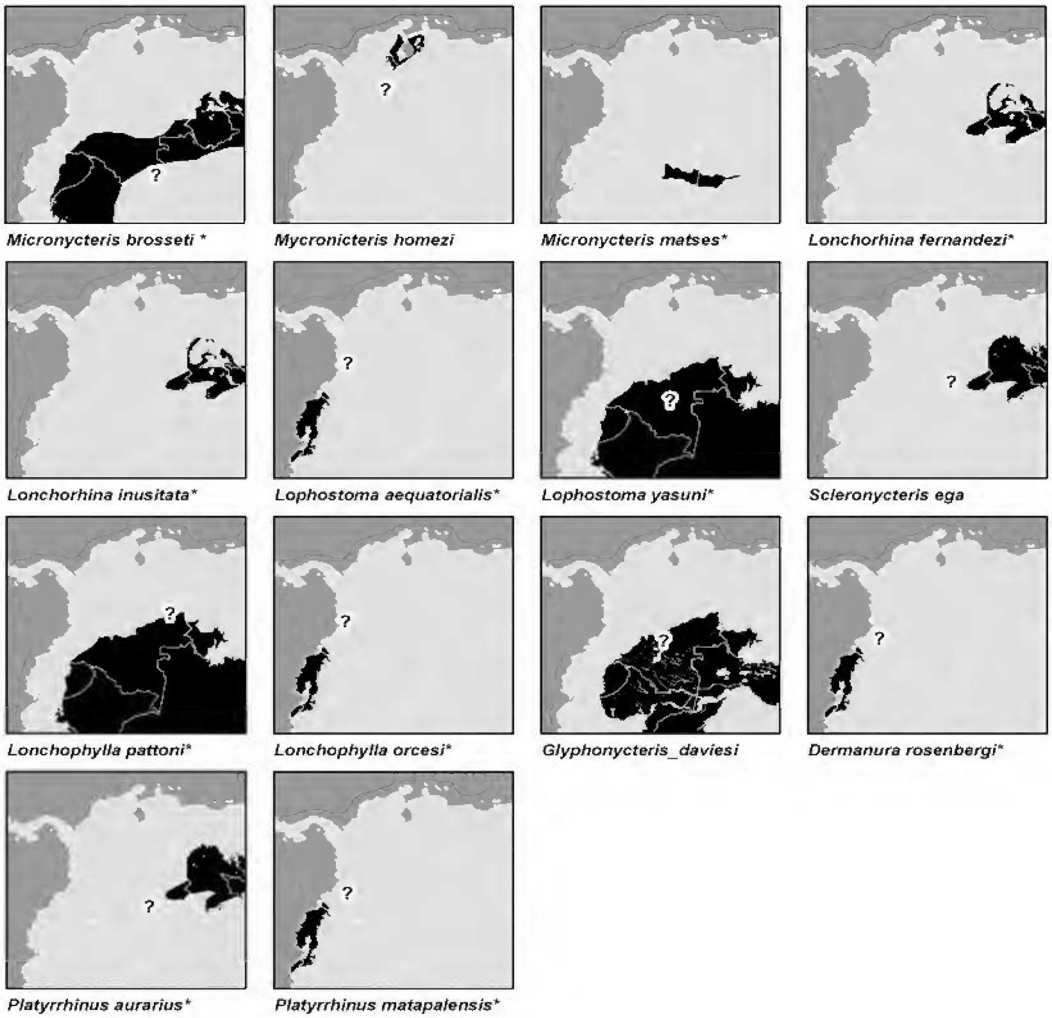

Dermanura watsoni


Ametrida centurio


Sphaeronycteris toxophyllum

APPENDIX II

Models of potential distribution for phyllostomid species potentially present in Colombia.



APPENDIX III

List of bibliographic references of published mammalian species checklists that include phyllostomid departmental records for Colombia. The listed references were used as sources in constructing column two of Table 1.

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APPENDIX III (CONT.)

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APPENDIX IV

Presence matrix of Colombian phyllostomid species by region used to perform the hierarchical cluster analysis of bat composition similarity among Colombian natural regions.

	Natural Region				
Species	**Ama**	**And**	**Car**	**Ori**	**Pac**
Lampronycteris brachyotis	1	1	1	0	0
Micronycteris hirsuta	1	1	1	0	1
Micronycteris megalotis	1	1	1	1	1
Micronycteris microtis	1	1	1	1	0
Micronycteris minuta	1	1	1	1	1
Micronycteris schmidtorum	1	1	1	0	1
Desmodus rotundus	1	1	1	1	1
Diaemus youngi	1	1	1	1	1
Diphylla ecaudata	1	1	1	1	1
Lonchorrhina aurita	1	1	1	1	1
Lonchorrhina marinkellei	1	0	0	0	0
Lonchorrhina orinocensis	1	0	0	1	0
Macrophyllum macrophyllum	1	1	1	1	1
Trachops cirrhosus	1	1	1	1	1
Lophostoma brasiliense	1	0	1	0	0
Lophostoma carrikeri	1	0	0	1	0
Lophostoma silvicolum	1	1	1	1	1
Mimon bennettii	1	0	0	1	0
Mimon cozumelae	0	0	1	0	1
Mimon crenulatum	1	1	1	1	1
Phylloderma stenops	1	1	1	1	1
Phyllostomus discolor	1	1	1	1	1
Phyllostomus elogatus	1	0	0	0	0
Phyllostomus hastatus	1	1	1	1	1
Phyllostomus latifolius	1	0	0	0	1
Tonatia saurophila	1	1	0	1	1
Chrotopterus auritus	1	1	1	1	1
Vampyrum spectrum	1	1	1	1	1
Anoura aequatoris	0	1	0	0	0
Anoura cadenai	0	1	0	0	1
Anoura caudifer	1	1	1	1	0
Anoura cultrata	0	1	1	0	1
Anoura fistulata	0	1	0	0	0
Anoura geoffroyi	1	1	1	1	1
Anoura latidens	0	1	0	0	0
Anoura luismanueli	0	1	0	0	0
Choeroniscus godmani	0	1	1	0	0
Choeroniscus minor	1	1	0	0	0

APPENDIX IV (CONT.)

	Natural Region				
Species	**Ama**	**And**	**Car**	**Ori**	**Pac**
Choeroniscus periosus	0	0	0	0	1
Lichonycteris degener	1	0	0	0	0
Lichonycteris obscura	1	0	0	0	1
Scleronycteris ega	1	0	0	0	0
Glossophaga commissarisi	1	1	0	0	0
Glossophaga longirostris	0	1	1	0	0
Glossophaga soricina	1	1	1	1	1
Leptonycteris curasoae	0	1	1	0	0
Lionycteris spurrelli	1	1	1	0	1
Lonchophylla cadenai	0	1	0	0	1
Lonchophylla chocoana	0	0	0	0	1
Lonchophylla concava	0	1	1	0	1
Lonchophylla fornicata	0	0	0	0	1
Lonchophylla handleyi	0	1	0	0	0
Lonchophylla orienticollina	0	1	1	0	0
Lonchophylla robusta	0	1	1	0	1
Lonchophylla thomasi	1	1	1	1	1
Carollia brevicaudata	1	1	1	1	1
Carollia castanea	1	1	1	1	1
Carollia monohernandezi	0	1	1	0	1
Carollia perspicillata	1	1	1	1	1
Rhinophylla alethina	0	0	0	0	1
Rhinophylla fischerae	1	0	0	0	0
Rhinophylla pumilio	1	0	0	1	0
Glyphonycteris sylvestris	1	0	1	0	0
Neonycteris pusilla	1	0	0	0	0
Trinycteris nicefori	1	1	0	0	1
Sturnira aratathomasi	0	1	0	0	0
Sturnira bidens	0	1	0	0	0
Sturnira bogotensis	0	1	0	0	0
Sturnira erythromus	0	1	0	0	0
Sturnira koopmanhilli	0	1	0	0	1
Sturnira lilium	1	1	1	1	1
Sturnira luisi	0	0	0	0	1
Sturnira magna	1	0	0	0	0
Sturnira mistratensis	0	1	0	0	0
Sturnira oporaphilum	0	1	0	0	1
Sturnira tildae	1	1	1	0	0
Chiroderma salvini	0	1	0	0	1
Chiroderma trinitatum	1	0	1	0	0
Chiroderma villosum	1	0	1	0	1

APPENDIX IV (CONT.)

	Natural Region				
Species	Ama	And	Car	Ori	Pac
Platyrrhinus albericoi	0	1	1	0	0
Platyrrhinus aquilus	0	1	1	0	0
Platyrrhinus brachycephalus	1	0	0	0	0
Platyrrhinus chocoensis	0	0	0	0	1
Platyrrhinus dorsalis	1	1	1	1	1
Platyrrhinus helleri	1	1	1	1	1
Platyrrhinus incarum	1	0	0	0	0
Platyrrhinus infuscus	1	0	0	0	0
Platyrrhinus ismaeli	0	1	0	0	0
Platyrrhinus nigellus	0	1	1	0	0
Platyrrhinus umbratus	0	1	1	0	0
Platyrrhinus vittatus	1	1	1	1	1
Platyrrhinus sp. nov.	0	0	0	0	1
Uroderma bilobatum	1	1	1	1	1
Uroderma magnirostrum	1	1	1	1	1
Vampyressa melissa	1	1	0	0	0
Vampyressa thyone	1	1	1	1	1
Vampyriscus bidens	1	1	0	0	0
Vampyriscus brocki	1	0	0	0	0
Vampyriscus nymphaea	0	0	0	0	1
Vampyrodes caraccioli	1	1	1	1	1
Enchistenes hartii	1	1	1	1	1
Mesophylla macconnelli	1	1	1	1	1
Artibeus amplus	0	1	1	0	0
Artibeus concolor	1	1	0	0	0
Artibeus jamaicensis	0	0	1	1	1
Artibeus lituratus	1	1	1	1	1
Artibeus obscurus	1	1	0	0	0
Artibeus planirostris	1	1	1	0	0
Dermanura anderseni	1	0	0	0	0
Dermanura bogotensis	0	1	0	0	0
Dermanura glauca	1	1	1	1	1
Dermanura gnoma	1	0	0	0	0
Dermanura phaeotis	0	1	1	0	1
Dermanura rava	0	1	0	0	1
Dermanura tolteca	0	1	0	0	1
Dermanura watsoni	0	1	0	0	1
Ametrida centurio	1	0	0	0	0
Sphaeronycteris toxophyllum	1	1	1	0	0